Citect for Windows
Driver Specification Extract
PROFIBD Driver

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3. Target Device(s) and Protocol

3.1 Introduction

This section defines the types of I/O Devices that are targeted by this driver.

3.2 Device Manufacturer

This is a generic driver for IODevice's which support Profibus at FMS level. Examples of such IODevices are S5, S7 and Weidmuller.

PROFIBUS-FMS is the general-purpose solution for communication tasks at the cell level. Powerful FMS services open up a wide range of applications and provide great flexibility. PROFIBUS-FMS can also be used for extensive and complex communication tasks.

3.3 Device Definition

The PROFIBD driver is designed to communicate to devices which support Profibus at the FMS level. Since it is a upgrade version of PROFI driver, it supports all the devices which PROFI driver does.

PROFIBUS specifies the technical and functional characteristics of a serial fieldbus system with which decentralized digital controllers can be networked together from the field level to the cell level. PROFIBUS distinguishes between master devices and slave devices.

Master devices determine the data communication on the bus. A master can send messages without an external request when it holds the bus access rights (the token). Masters are also called active stations in the PROFIBUS protocol.

Slave devices are peripherial devices. Typical slave devices include input/output devices, valves, drives and measuring transmitters. They do not have bus access rights and they can only acknowledge received messages or send messages to the master when requested to do so. Slaves are also called passive stations. Since they only require a small portion of the bus protocol, their implementation is particularly economical.

3.4 Communications Method

Profibus is a token ring network running over a RS485 physical connection. The PROFIBUS network corresponds to the German process and Fieldbus standard PROFIBUS DIN 19245. In PROFIBUS-FMS, layers 1, 2 and 7 are defined. The application layer consists of FMS (Fieldbus Message Specification) and LLI (Lower Layer Interface). FMS contains the application protocol and provides the user with a wide selection of powerful communication services. LLI implements the various communication relationships and provides FMS with device-independent access to layer 2. Layer 2 (FDL, Fieldbus Data Link) implements bus access control and data security. RS 485 transmission technology or fiber optics are available for transmission for PROFIBUS-FMS.

RS 485 transmission is the transmission technology most frequently used by PROFIBUS. This transmission technology is often referred to as H2. Its application area includes all areas in which high transmission speed and simple inexpensive installation are required. Twisted pair shielded copper cable with one conductor pair is used.

The RS 485 transmission technology is very easy to handle. Installation of the twisted pair cable does not require expert knowledge. The bus structure permits addition and removal of stations or step-by-step commissioning of the system without influencing the other stations. Later expansions have no effect on stations which are already in operation.

Transmission speeds between 9.6 kbit/sec and 12 Mbit/sec can be selected. One unique transmission speed is selected for all devices on the bus when the system is commissioned.

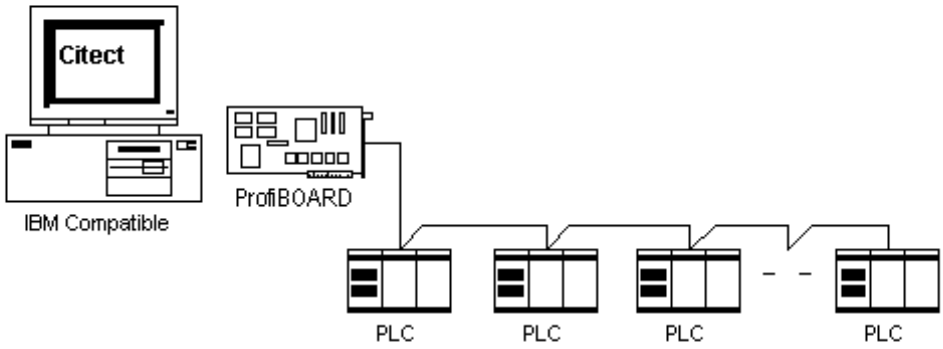
Network topology Linear bus, active bus termination on both ends, stub lines only permitted for baud rates of <= 500 kbit/sec. Shielding may be omitted depending on the environmental conditions (EMC). 32 stations are allowed in each segment without repeaters, up to 127 stations with repeaters.

Fiber optic conductors can be used for PROFIBUS for applications in environments with very high electromagnetic interference and to increase the maximum distance for high transmission speeds. Two types of conductors are available. Inexpensive plastic fiber conductors for distances <= 50 m or glass fiber conductors for distances <= 1 km.

Many vendors offer special bus plug connectors with integrated conversion of RS 485 signals to fiber optic conductors and vice versa. This provides a very simple method of switching between RS 485 transmission and fiber optic transmission within one system. See PROFIBUS guideline 2.022 for the specification of the PROFIBUS-FO transmission technique.

3.5 Communications/Hardware Configuration

3.5.1 Wiring Diagrams



3.5.2 I/O Device Settings

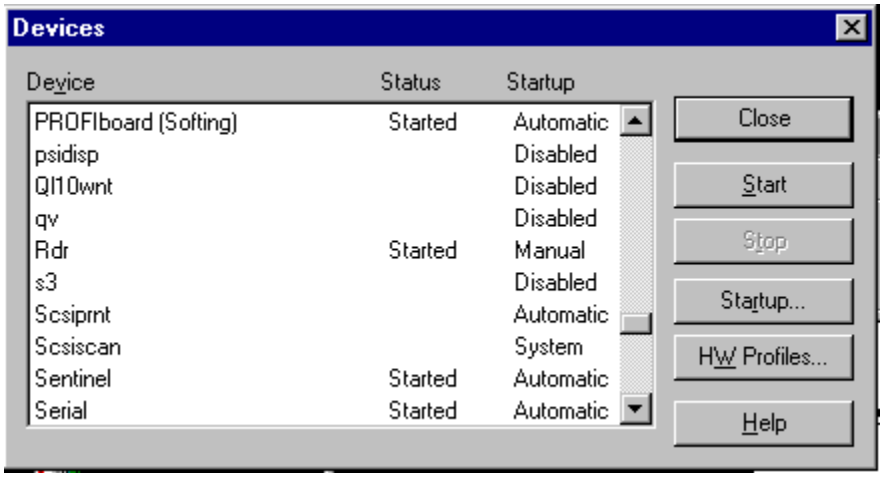
See manual associated with specific device for detailed configuration information

3.5.3 Software Setup (NT 4.0 only)

The NT software for the PROFIboard card consists of a setup program which installs the Softing drivers required.

To setup the PROFIBoard:
1. Start by installing the hardware card into the PC.
2. Logg on with Administrator rights.
3. Insert the “PROFIBoard NT” diskette into your diskette driver, if you have downloaded the files from the Internet jump to point 5.
4. From the Start menu select “Run…”
5. Type “A:\Install” or if you have the installation files on your harddisk, type in the path and the filename to that location.
6. Click “OK”

Note! If you are unsure about the cards settings, choose “AutoConfig” during the installation.
After installation, make sure that the Softing PROFIboard is enabled in the Windows Control Panel / Devices:



If you need to change the cards’ IO area, you may change the 8 dip switches on the card. The DIP switch have the following values:

Switch	Value
1	200hex
2	100hex
3	80hex
4	40hex
5	20hex
6	10hex
7	8hex
8	4hex

Default is (10010000) = 240hex.

The event log (viewed with the Event Viewer) will tell you what address and interrupt the PROFIboard is set to. Make sure to copy the **PAPI50.DLL** file from the installation directory (defaults to \Program Files\Profibus\Profiboard\PAPI\DLL) to the Citect\Bin directory.

3.6 Special Requirements

A Softing PROFIboard card is required to be installed in the Citect computer. The card is then physically connected to the PROFIBUS network on which target PLCs resides.

This driver will only work on Windows NT 4.0
The client will need to purchase the ProfiBOARD and the software from Softing GmbH or Ci Technologies.

3.6.1 Windows NT 4.0 version

Ordering information from Softing:
Hardware: PB-IF-03
Software: PROFI-DMK-NT (ver 5.11A)

3.6.2 Windows 95 version

A Windows 95 version of the PROFIBD driver is not available.

3.7 Maximum Request Length

2048 bits

5. User Interface

5.1 Introduction

This section defines how the user will see the driver. This relates directly to how the Citect forms need to be filled out and any special INI options. For the kernel, the debug trace messages and the Stats.Special counters are documented.

5.2 Driver Name

PROFIBD

5.3 Boards Form

5.3.1 Board Type

PROFIBD

5.3.2 Address

0xD000 or 0xE000
Note! This value is sometimes referred to the same as above but with 4 zero's, for example 0xD0000. As the last zero is always a zero a common practise is to simply drop the last zero which gives 0xD000. This value is found in one of the events in the event viewer for the PROFIBoard, look at the source "PROFIbrd".

5.3.3 IO Port

Use the value which has been set on the Softing card. See section 3.5.3 for details on the DIP switches.
e.g.: 0x240

5.3.4 IRQ

Not Used

5.3.5 Special Opt

Not Used

5.4 Ports Form

5.4.1 Port Number

Not Used

5.4.2 Baud Rate

9.6 Kbit/s - 12Mbit/s (select one according to the specific devices)

Transmission Rate	Citect Entry
9.6 Kbit/s	9600
19.2 Kbit/s	19200
93.75 Kbit/s	93750
187.5 Kbit/s	187500
500 Kbit/s	500000
1.5 Mbit/s	1500000
3 Mbit/s	3000000

6 Mbit/s	6000000
12 Mbit/s	12000000

5.4.3 Data Bits

Not used

5.4.4 Stop Bits

Not used

5.4.5 Parity

Not used

5.4.6 Special Opt

Not used

5.5 IO Devices Form

5.5.1 Protocol

PROFIBD

5.5.2 Address

Local_sap Remote_address Remote_Seg Remote_lsap Name_Of_Device
e.g 128 1 255 4 WEIDMULLER
where

128	local sap (lsap)
1	remote address (raddr)
255	remote segment (rseg)
4	remote sap (rlsap)
WEIDMULLER	name of the section heading in Citect.ini under where all the parameters related to WEIDMULLER will be put)

5.6 Pulldown lists Help

TYPE	DATA	FILTER
BOARDTYPE	**PROFIBD**	
PROTOCOL	**PROFIBD**	
ADDRESS		**PROFIBD**
IOPORT		**PROFIBD**

5.7 IO Device Variable Types

IO Device Type	Citect data type	Citect data type	Description/Special Usage/Limitations/ Valid Ranges
INTEGER (16bit) arrays	<index>[/<sub index>[.bit]]	DIGITAL, INT, LONG, REAL, BYTE, STRING	READ/WRITE
B	B<index>[/<sub index>[.bit]]	BYTE	READ/WRITE
R	R<index>[/<sub index>[.bit]]	REAL	READ/WRITE
L	L<index>[/<sub index>[.bit]]	LONG	READ/WRITE
BWR	BWR<index>	REAL	Block Write Array Native
BWL	BWL<index>	LONG	Block Write Array Native
BW	BW<index>	INTEGER	Block Write Array Native
SL	SL<index>	STRING	String with size set by read length
S	S<len>:<index>	STRING	String with size set by user
S32TM	S32TM<index>	STRING	32 bit Profibus time/date format. Format- HH:MM:SS.MSMSMS e.g. 12:34:56.000
S48DIF	S48DIF<index>	STRING	48 bit Profibus time difference Format- HH:MM:SS.MSMSMS e.g. 33:33:33.000
S48DT	S48DT<index>	STRING	48 bit Profibus date only format Format- DD:MM:YYYY e.g. 10:11:1999
S48TMDT	S48TMDT<index>	STRING	48 bit Profibus time date format Format- D:MM:YYYY HH:MM:SS.MSMSMS e.g. 10:11:1999 12:34:56.000
SU48DT	SU48DT<index>	STRING	48 bit Unigyr date only format Format- Either Yearless date (DD.MM) or DD:MM:YYYY HH:MM:SS.MSMSMS or DD:MM:YYYY
SU32TM	S32TM<index>	STRING	32 bit Profibus time/date format (without milliseconds). Format- HH:MM:SS e.g. 12:34:56
SU48DIF	S48DIF<index>	STRING	48 bit Profibus time difference (without milliseconds) Format- HH:MM:SS e.g. 33:33:33
SU48TMDT	S48TMDT<index>	STRING	48 bit Profibus time date format (without milliseconds) Format- D:MM:YYYY HH:MM:SS e.g. 10:11:1999 12:34:56

Where:

<index>	A valid variable index
<sub index>	index of the array element required (1 to 255)
<bit>	Bit specifier for DIGITAL variables
<len>	Wite length to specify in the protocol request when writing this type to the PLC

5.8 PROFIBD.DBF

TEMPLATE	UNIT_TYPE	RAW_TYPE	BIT_WIDTH	LOW	HIGH	COMMENT
%F[.%u(0,0,15)]	0x00000	1	16	0	0	Simple variables
%F/%U(0,1,255)[.%u(0,0,15)]	0x10000	1	16	0	0	Array variables
B%F[.%u(0,0,15)]	0x20000	8	8	0	0	Simple Native Byte
B%F/%U(0,1,255)[.%u(0,0,15)]	0x30000	8	8	0	0	Array Native Byte
R%F	0x00000	2	32	0	0	Simple Native Real
R%F/%U(0,1,255)	0x10000	2	32	0	0	Array Native Real
L%F	0x00000	4	32	0	0	Simple Native Long
L%F/%U(0,1,255)	0x10000	4	32	0	0	Array Native Long
BWR%F/%U(0,1,255)	0x50000	2	32	0	0	Block Write Array Native
BWL%F/%U(0,1,255)	0x50000	4	32	0	0	Block Write Array Native
BW%F/%U(0,1,255)	0x50000	1	16	0	0	Block Write Array Native
SL%F	0x60000	7	1024	0	0	String with size set by read length
S32TM%F	0x70000	7	200	0	0	32 bit Profibus time/date format
S48DIF%F	0x80000	7	200	0	0	48 bit Profibus time difference
S48DT%F	0x90000	7	200	0	0	48 bit Profibus date only format
S48TMDT%F	0xA0000	7	200	0	0	48 bit Profibus time date format
S%<24(0,1,256):%F	0xB0000	7	1024	0	0	String with size set by user
SU48DT%F	0xC0000	7	200	0	0	48 bit Unigyr date only format
SU32TM%F	0xD0000	7	200	0	0	32 bit Profibus time/date format without milleseconds
SU48DIF%F	0xE0000	7	200	0	0	48 bit Profibus time difference without milleseconds
SU48TMDT%F	0xF0000	7	200	0	0	48 bit Profibus time date format without milleseconds

5.9 Parameters and INI options

5.9.1 Standard Parameters

Block	128
Delay	0
MaxPending	4
Polltime	10 ms
Timeout	4000 ms
Retry	2
WatchTime	30

5.9.2 Driver Specific Parameters

[PROFIBD]

window	Display the profibus debug window
Local_Address	Address of this station on the PROFIBUS network
Local_Segment	Segment for this station on the PROFIBUS network
Tsl	Slot Time
Min_Tsdr	Minimum Station Delay Time
Max_Tsdr	Maximum Station Delay Time
Tqui	Quiet Time
Tset	Setup Time
Ttr	Desired Target Rotation Time
G	Gap update factor
In_Ring_Desired	This station must be in the token ring
Hsa	Highest station Address on the PROFIBUS network
Max_Retry_Limit	Number of Retries performed
Poll_Sap	Sap used for poll list processing
Symbol_Length	Max length of connection names
Ass_Abt_Ci	Timeout for associate and abort Services in 10ms intervals
[<unit>]	(<unit> = Name_of_Device field from IODevice | address), one topic per IODevice
MaxOutStanding	Number of outstanding reuqest a unit can handle. This must be less than or equal to Max_Scc and greater than 0
TestIndex	A Valid index to read as a test of the comms link. Used for Citect redundency.
Conn_Type	“MMAC” master async, or “MSAC” slave async depending if the device is a master (token holder) on the PROFIBUS networkor not.
Max_Scc	Max number of confirmed requests sent. The PROFIB driver reuqires at least one of these ie Max_Scc = 1.
Max_Rcc	Max number of confirmed indications received.
Max_Sac	Max number of unconfirmed requests sent.
Max_Rac	Max number of unconfirmed indications received.
Ci	Control interval, time (x 10ms) Citect requires 0 ie no checks made.
Max_Pdu_Snd_High Max_Pdu_Snd_Low	Sent PDU sizes must be less than or equal to the destination device receive PDU sizes.
Max_Pdu_Rcv_High Max_Pdu_Rcv_Low	Receive PDU sizes must be greater than or equal to the destination devices send PDU sizes.
Feature_Support_0 Feature_Support_1 Feature_Support_2	These relate to the services supported by the destination device as a server. Citect requires support for READ and WRITE services. The device is a server and Citect the client. (NOTE! Entered as DECIMAL values, not HEX)
Feature_Support_3 Feature_Support_4 Feature_Support_5	These relate to the services supported by the destination device as a client. Citect does not support any services as a server. Therefore the client services required are all normally disabled (set to zero). (NOTE! Entered as DECIMAL values, not HEX)

BUS PARAMETERS

1. Range of Values

The following figure lists all Bus Parameters with their definition and the range of value.

PARAMTER	RANGE OF VALUE	DESCRIPTION
loc_add	0..126	local station address
loc_segm	0..63 255	local segment address no segment address
baud_rate	0	9.6 Kbit/s

	1 2 3 4 6 7 8 9	19.2 Kbit/s 93.75 Kbit/s 187.5 Kbit/s 500 Kbit/s 1.5 Mbit/s 3 Mbit/s 6 Mbit/s 12 Mbit/s
medium_red	0	no bus redundancy
tsl	37..16383	slot time
min_tsdr	11..1023	min station delay time
max_tsdr	35..1023	max station delay time
tqui	0..127	quiet time
tset	1..479	setup time
ttr	256..16777215	target rotation time
g	1.255	gap update factor
in_ring_desired	0 255	passive station active station
hsa	1..126	highest station address
max_retry_limit	0..7	max retry limit
ident		FDL ident string

2. Recommended Bus Parameters for FMS Operation

For FMS-operation the PROFIBUS Nutzer Organization (PNO) recommends baudrates up to 500 Kbit/s with following values:

baudrate (Kbit/s)	9.6	19.2	93.75	187.5	500	1500
tsl	100	200	500	1500	3000	-
min_tsdr	30	60	125	250	500	-
max_tsdr	50	100	250	500	1000	-
tset	5	10	15	25	50	-
tqui	22	22	22	22	22	-
ttr	10000	15000	30000	50000	100000	-
g	1	1	1	1	1	-
hsa	126	126	126	126	126	-
max_retry_limit	1	1	1	1	1	-

3. COMMUNICATION RELATIONSHIP LIST (CRL)

The Communication Relationship List (CRL) contains the specific description of all network communication relationships of FAL, independent the time of use. The CRL is structured as a CRL header and CRL entries. The CRL header and each CRL entry are identified by the Communication Reference (CR).

4. CRL Header

The CRL header consists of attributes which define the whole CRL. The following figure shows the parameter with their definition, the range of value and the defined constants.

PARAMETER	RANGE OF VALUE	DEFINE	DESCRIPTION
nr_of_entries	0..128	0..MAX_COMREF	number of CRL entries
poll_sap	0,2..61 128	 DEFAULT_SAP	poll list SAP
symbol_length	0.32	0..CRL_SYMBOL	length of CRL symbol
ass_abt_ci	1..4294967295		ASS/ABT control interval
vfd_pointer_supported	0	PB_FALSE	one VFD supported

	255	PB_TRUE	multiple VFDs supported

5. CRL Entry

The CRL entry contains the complete description of the station's communication relationships. The following figure lists the parameters with their definition, the range of value of value and the defined constants.

PARAMETER	RANGE OF VALUE	DEFINE	DESCRITION
loc_lsap	0..62 63 128	 BRCT_SAP DEFAULT_SAP	local SAP
rem_add	0..124 127 255	 GLOBAL_ADDR ALL	remote station address used for Broadcast
rem_segm	0..63 255	 NO_SEGMENT	remote segment address
rem_lsap	0..62 63 128 255	 BRCT_SAP DEFAULT_SAP ALL	remote SAP
conn_type	(see below)	(see below)	connection type
LLI_sap	0 1	FMS_SAP FM7_SAP	LLI SAP for FMS LLI SAP for FM7
multiplier	0..255		multiplier on cyclic connections
conn_attr	(see below)	(see below)	connection attribtue
max_scc	0..20		max send confirmed counter
max_rcc	0..20		max receive confirmed counter
max_sac	0..20		max send acknowledge counter
max_rac	0..20		max received acknowledge counter
ci	$0..2^{32-1}$		control intervall
max_pdu_snd_high	0..241		max FMS/FM7 PDU length send high
max_pdu_snd_low	0..241		max FMS/FM7 PDU length send low
Max_pdu_rcv_high	0..241		max FMS/FM7 PDU length receive high
Max_pdu_rcv_low	0..241		max FMS/FM7 PDU length receive low
Feature_supp			supported FMS/FM7 features
Sumbol			symbolic name
Vfd_pointer	$0..2^{16-1}$		vfd number
Extension			extention

CITECT.INI example for a single Weidmuller system (Note! Multiple IODevices require unique entries in the CITECT.INI)

```
[profibd]
debugstr=* all
window=1
LOCAL_ADDRESS=3
LOCAL_SEGMENT=255
POLL_SAP=128
LOG=1

[WEIDMULLER]
MaxOutstanding=1
TestIndex=40
conn_type="MSAC"
```

Max_pdu_snd_high=0
Max_pdu_snd_low=49
Max_pdu_rcv_high=0
Max_pdu_rcv_low=241
Ci=0

5.10 Driver Specific Errors

See section 5.12

5.11 Driver Error Help

NONE

5.12 Debug Messages

Driver Errors
format: 0xAAIIRRRR

where
AA - Area

ERROR_OTHER	0x00
ERROR_TIMEOUT	0x01
ERROR_REC	0x02
ERROR_SND	0x03
ERROR_FM7_NEG	0x04
ERROR_FM7_ABORT	0x05
ERROR_FM7_EVENT	0x06
ERROR_FMS_NEG	0x07
ERROR_INITIATE	0x08
ERROR_ABORT	0x09
ERROR_UNKNOWN_SERVICE	0x0a

II - Instance of the code
Instance Id codes:

USR	0
LLI_USR	1
LLI	2
FDL / FMA2	3

RRRR -Reason for Error
Too many to be listed here, see manual for the detailed information.

5.13 Special Debugging Information

The Profibus Debug Window
This window is an important aid in debugging connections to a device. To activate the window set the following Citect INI parameter:
[PROFIBD]
window=1

The output displays the services requested from the lower level PROFIBUS interface and the responses. Many of the PROFIBUS network and connection parameters are displayed so that they can be checked as the driver attempts to make a connection. Error information is also displayed.

The debugging window supports the key command D to toggle the display on / off. And the key L to toggle logging the same output to a file as described below.

The information from the debug window can be logged to file. This is only recommended for testing as it may make Citect unstable. To log to file:

- Create an empty text file called PROFIBD.LOG in a directory called C:\WINDOWS.
- Add the entry [PROFIBD]LOG=1 to the Citect INI file.
- Start Citect

5.14 Stats Special Counters

NONE

5.15 Hints and Tips

i) On the PROFIBoard there is a small green lamp which should go on when Citect runtime starts up and it should go off when Citect runtime is shutdown.

ii) If you get no errors in the Event Log at startup but Citect “hangs” when it tries to initialize the card you may have a hardware conflict. Remove all other hardware’s in the PC and try again.

iii) Installation Hints for RS 485

Transmission
All devices are connected in a bus structure (i.e., line). Up to 32 stations (master or slaves) can be connected in one segment. The bus is terminated by an active bus terminator at the beginning and end of each segment. To ensure error-free operation, both bus terminations must always be powered. Many vendors have designed a switchable bus termination in their devices or plug connectors. When more than 32 stations are used, repeaters (line amplifiers) must be used to connect the individual bus segments.

The maximum cable length depends on the transmission speed. See the table below. The specified cable length can be increased by the use of repeaters. The Use of more than 3 repeaters in series is not recommended.

Baud rate (kbit/sec)	Distance/segment
9.6	1200 m
19.2	1200 m
93.75	1200 m
187.5	1000 m
500	400 m
1500	200 m
12000	100 m

When connecting the stations, make sure that the data lines are not twisted. Use of shielded data lines is absolutely essential to the achievement of high system immunity in environments with high electromagnetic emissions (e.g., automobile manufacturing). Shielding is used to improve electromagnetic compatibility (EMC). The shield braiding and, if present, the shield foil should be connected to protective ground on both sides and with good conductivity via shield clamps covering as large an area as possible. In addition, it is recommended that the data lines be kept separate from all high-voltage cables.

Stub lines should be avoided for data transmission speeds of more than 500 kbit/sec. Plug connectors available on the market permit the incoming data cable and the outgoing data cable to be connected directly in the plug connector. This means that stub lines do not have to be used, and the bus plug connector can be connected and disconnected at all times without interrupting data communication with the other stations.

8. References

8.1 References

PROFIBUS Application Program Interface
User Manual Version 5.0 Rev. 03 31/1/96
Softing GmbH